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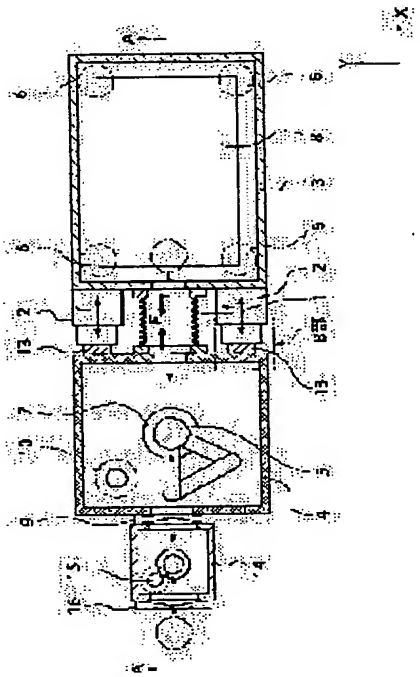
(71)Applicant : NIKON CORP
SENDAI NIKON:KK
(72)Inventor : KIKUCHI HIDEKAZU
WATSON DOUGLAS C

(54) LOAD-CANCELING MECHANISM, VACUUM CHAMBER COUPLING BODY, ALIGNER, AND PRODUCING METHOD OF SEMICONDUCTOR DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a load-canceling mechanism, which can prevent vibrations, which are produced in one of vacuum chambers from propagating to the other vacuum chamber, by removing effectively a compression force applied for bellows, when two vacuum chambers are coupled with bellows.
SOLUTION: Two vacuum chambers 3 and 4 have coil spring-shaped flexibility, are joined each other and are connected by a bellows 1 with a hollow inside. Therefore, because the inside of bellows 1 is at a vacuum, an enormous compressive force is applied to the bellows 1. Two air springs 2 are arranged in parallel with bellows 1 and located at equal distance from the bellows 1, of which the Z-orientation locations of both sides are equal, and a force F applied to the bellows 1 is half shared by each, and load is canceled, to eliminate this compressive force.



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CLAIMS

[Claim(s)]
[Claim 1] The load cancellation device which is a load cancellation device which cancels the force generated in the bellows used in order to connect two vacuum chambers, and is characterized by combining said two vacuum chambers with an elastic body.
[Claim 2] The load cancellation device characterized by being a load cancellation device according to claim 1, and said elastic body being a pneumatic spring.
[Claim 3] The load cancellation device which is a load cancellation device according to claim 1 or 2, and is characterized by establishing the device which absorbs pitching, rolling, and yawing in the load transfer section of said elastic body, and the device which absorbs the variation rate of a right-angled 2-way to the shaft orientations of said elastic body.
[Claim 4] The force which is the load cancellation device which cancels the force generated in the bellows used in order to connect two vacuum chambers, and is generated in said bellows according to the difference of the pressure in a vacuum chamber and an atmospheric pressure is a load cancellation device characterized by combining said two vacuum chambers with the combination which has other bellows which generate the force of the reverse sense.
[Claim 5] a load cancellation device according to claim 4 — it is — said — others — the load cancellation device characterized by combining the end face by the side of reverse with the 1st vacuum chamber with the 1st vacuum chamber, combining bellows with the 2nd vacuum chamber in the end face by the side of reverse with the 2nd vacuum chamber, and making the interior into the same pressure as a vacuum chamber.
[Claim 6] It is a load cancellation device according to claim 4. Said combination The cylinder body combined with the 1st vacuum chamber through the 1st bellows, It comes to have the piston object combined with the interior of the cylinder body concerned through the 2nd bellows. The piston object concerned is combined with the 1st vacuum chamber through a rod, and said cylinder body is combined with the 2nd vacuum chamber. It is the load cancellation device which space surrounded by the inside of the 1st bellows of said cylinder inside-of-the-body section, the 2nd bellows, a piston object, and a cylinder body is made into the same pressure as a vacuum chamber, and is characterized by making other parts into atmospheric pressure.
[Claim 7] Vacuum chamber combination which is the vacuum chamber combination which comes to join two vacuum chambers together with bellows, and is characterized by having arranged the load cancellation device given in any 1 term at equal intervals on plurality and the concentric circle centering on the core of said bellows among claim 1 to claims 6.
[Claim 8] Vacuum chamber combination which is the vacuum chamber combination which comes to join two vacuum chambers together with bellows, and is characterized by having arranged the load cancellation device given in any 1 term on a straight line among claim 1 to claims 6 in the location which becomes symmetrical to plurality and said bellows.
[Claim 9] The aligner characterized by for one side being the vacuum chamber which constitutes an aligner among claim 1 to claims 8 among the vacuum chambers of vacuum chamber combination given in any 1 term, and being the vacuum chamber to which another side contains the transport device which supplies a wafer to the aligner concerned.
[Claim 10] The manufacture approach of the semiconductor device characterized by using an aligner

according to claim 9 and coming to have the process which carries out the exposure imprint of the circuit pattern formed in the mask or the reticle at a wafer.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] In case this invention combines the vacuum chamber of the body of an aligner, and the vacuum chamber of the transport device which supplies a wafer to an aligner for example, in a semi-conductor aligner, it relates to the manufacture approach of the vacuum chamber combination combined by the load cancellation device and this load cancellation device for negating the load concerning the bellows which combines both, the aligner using it, and the semiconductor device which used that aligner.
[0002]
[Description of the Prior Art] For example, in a semi-conductor aligner, it is indispensable for a part for the principal part to be contained in the vacuum chamber, and to contain the lens-barrel part, a reticle stage, and a wafer stage in a vacuum chamber in the aligner adapting especially a charged-particle line. Therefore, it is necessary to also contain the transport device which supplies a wafer in the vacuum chamber, or is taken out in another vacuum chamber.
[0003] Drawing 9 and drawing 10 explain the conventional technique used in order to connect these two vacuum chambers. Drawing 9 is drawing showing the example of the equipment with which connection immobilization of the transport-device vacuum chamber is direct carried out to a wafer stage chamber. A gate valve 9 and a load lock chamber 14 are installed in a core by the transport-device vacuum chamber 4, and are installed in the carrier robot 7 and the bottom surface part by the vacuum pump 10 and the lateral portion.
[0004] The wafer stage 8 is installed in the interior of the wafer stage chamber 3, and the lens-barrel I of an illumination system, the reticle stage chamber R, and the lens-barrel P of a projection system are formed in the upper part. Moreover, in order to usually remove the effect of vibration of the disturbance transmitted from a floor etc., the vibrationproofing base 6 is installed, especially, a high precision positioning technique is needed for the wafer stage chamber 3, and the vibration control system which performs vibration-deadening control actively combining a pneumatic spring and a voice coil motor (usually referred to as VCM) is adopted as it with the aligner which dislikes disturbance.
[0005] Drawing 10 separates the transport-device vacuum chamber 4 and the wafer stage chamber 3, is bellows 1, and is drawing showing equipment conventionally connected between vacuum chambers. In this case, rigid-body connection of the transport-device vacuum chamber 4 and the wafer stage chamber 3 does not tend to be made, but it is going to ease that vibration of the transport-device vacuum chamber 4 gets across to the wafer stage chamber 3.
[0006]
[Problem(s) to be Solved by the Invention] However, since the transport-device vacuum chamber 4 and the wafer stage chamber 3 are connected direct in the case of the equipment shown in drawing 9 , it transmits to the wafer stage chamber 3, without vibration of the vacuum pump from a transport-device side, vibration of exhaust air, vibration of a carrier robot, etc. seldom declining, and transmits also to the wafer stage 8. Therefore, while the exposure process is performed by the wafer chamber 8 when a high precision positioning technique is needed for example, the above-mentioned transport device cannot be operated. That is, conveyance of a processing object (wafer) 5 and down stream processing cannot be performed to parallel, and serve as serial one-sheet method of one sheet. Therefore, it will have the fault that a throughput is not raised.

[0007] Moreover, in the case of the equipment shown in drawing 10 , the internal pressure of each part is P1>P2>P3, but since space is continuing, the three above-mentioned sorts of pressures turn into an almost equal pressure. In this case, the force used as the ****** wax proportional to the effective sectional area of bellows 1, i.e., the force of the compression direction, joins bellows 1. For example, in order to let the semi-conductor wafer of 300mm size pass, the compressive force generated when bellows with 50mmx336mm opening is used is set to about 3400 Ns. Even if the wafer stage chamber 3 is difficult for bearing although it mounts on an active vibrationproofing base, this compressive force, i.e., horizontal force, and it bears, since the current passed to VCM becomes large, VCM will generate heat and it will become very difficult to use it.
[0008] then, the bar 20 -- bellows 1 -- up and down -- or it arranges vertically and horizontally so that bellows 1 may be wrapped in, and it is made to have not buckled However, in this case, since the bar 20 has become rigid body-like, vibration of a vacuum pump 10 and a carrier robot 7 is transmitted to the wafer stage chamber 3, without decreasing not much. therefore, the case in the equipment which showed processing of a processing object 5 to drawing 9 -- the same -- a serial process -- not carrying out -- it will not obtain but will have the fault that a throughput is not raised.
[0009] When this invention is made in view of such a situation and two vacuum chambers are combined with bellows, the compressive force concerning bellows is negated on an effective target, and vibration generated from one vacuum chamber makes it a technical problem to offer the manufacture approach of the aligner using the load cancellation device in which it can prevent getting across to the vacuum chamber of another side and the vacuum chamber combination using it, and this vacuum chamber combination, and the semiconductor device using this aligner.
[0010]
[Means for Solving the Problem] The 1st means for solving said technical problem is a load cancellation device which cancels the force generated in the bellows used in order to connect two vacuum chambers, and is a load cancellation device (claim 1) characterized by combining said two vacuum chambers with an elastic body.
[0011] Although compressive force will act on bellows if two vacuum chambers are connected with bellows as mentioned above, in this means, he combines two vacuum chambers with an elastic body, and is trying to cancel this compressive force according to the elastic force of an elastic body. An elastic body cannot transmit easily vibration generated in one vacuum chamber to the chamber of another side. Therefore, since conveyance actuation and processing actuation can be performed also in parallel to the case where the processing-object transport device to an aligner etc. is prepared in one vacuum chamber, and the main frames, such as an aligner, are formed in the vacuum chamber of another side, the throughput of the whole equipment can be raised.
[0012] The 2nd means for solving said technical problem is said 1st means, and is characterized by said elastic body being a pneumatic spring (claim 2).
[0013] Also among elastic bodies, especially a pneumatic spring has the large damping effect of vibration, and amounts to about 1 / ten to 1/100. Moreover, big elastic force can be taken out also with the small cross section by heightening the pressure of the air enclosed with inside. Therefore, it is small, and the big oscillating reduction effectiveness can be taken out and it is especially effective.
[0014] The 3rd means for solving said technical problem is said the 1st means or 2nd means, and is characterized by establishing the device which absorbs pitching, rolling, and yawing in the load transfer section of said elastic body, and the device which absorbs the variation rate of a right-angled 2-way to the shaft orientations of said elastic body (claim 3).
[0015] Although an elastic body can absorb vibration of the shaft orientations effectively, the force which absorbs the variation rate or bending displacement to the direction of other is weak. This is remarkable in especially a pneumatic spring. In this means, since he is trying to absorb according to the device which prepared the variation rate of the 5 remaining shaft orientations in the load transfer section of an elastic body, it propagation-comes to be hard of vibration of every direction from one vacuum chamber to the vacuum chamber of another side.
[0016] It is the load cancellation device which cancels the force generated in the bellows used in order that the 4th means for solving said technical problem may connect two vacuum chambers, and the force which generates in said bellows according to the difference of the pressure in a vacuum chamber and an atmospheric pressure is the load cancellation device (claim 4) characterized by to combine said two

vacuum chambers with the combination which has other bellows which generate the force of the reverse sense.
[0017] Since he is trying to cancel the force generated in the bellows used in order to connect two vacuum chambers by hanging and uniting the force generated in bellows according to the difference of the pressure in a vacuum chamber, and an atmospheric pressure in this means, even when a degree of vacuum changes, the balance of the force is maintained, and it is not necessary to change the force to apply. Moreover, vibration of 6 shaft orientations is absorbable to some extent.
[0018] the 5th means for solving said technical problem — said 4th means — it is — said — others — with the 1st vacuum chamber, the end face by the side of reverse is combined with the 1st vacuum chamber, the end face by the side of reverse is combined with the 2nd vacuum chamber with the 2nd vacuum chamber, and bellows is characterized by making the interior into the same pressure as a vacuum chamber (claim 5).
[0019] In this means, if other bellows tend to shrink by the differential pressure of inside thickness (vacuum) and external pressure (atmospheric pressure), force which pulls apart two vacuum chambers will work. Therefore, two or more such other bellows are prepared, and if it is made to become almost the same as the cross-sectional area of the bellows used in order that total of these cross-sectional area may connect two vacuum chambers, the compressive force concerning the bellows used in order to connect two vacuum chambers can be negated nearly completely. In this means, even when a degree of vacuum changes, the balance of the force is maintained, and it is not necessary to change the force to apply. Moreover, vibration of 6 shaft orientations is absorbable to some extent.
[0020] The 6th means for solving said technical problem is said 4th means. Said combination The cylinder body combined with the 1st vacuum chamber through the 1st bellows, It comes to have the piston object combined with the interior of the cylinder body concerned through the 2nd bellows. The piston object concerned is combined with the 1st vacuum chamber through a rod, and said cylinder body is combined with the 2nd vacuum chamber. It is characterized by making into the same pressure as a vacuum chamber space surrounded by the inside of the 1st bellows of said cylinder inside-of-the-body section, the 2nd bellows, a piston object, and a cylinder body, and making other parts into atmospheric pressure (claim 6)..
[0021] In this means, if the cross-sectional area of A1 and a piston object is set to A2 for the cross-sectional area of the 1st bellows and an atmospheric pressure is set to Pa, the compressive force of only Pa-A1 will work between the 1st vacuum chamber and a cylinder, and this will pull the 2nd vacuum chamber to a 1st vacuum chamber side. Moreover, between the 1st vacuum chamber and piston, the repulsive force of only Pa-A2 works through a rod, and this keeps away the 2nd vacuum chamber from a 1st vacuum chamber side through a cylinder. After all, the repulsive force of only Pa- (A2-A1) will work between the 1st vacuum chamber and the 2nd vacuum chamber. Therefore, two or more such combination is prepared, and compressive force is cancellable if it is made for the sum of those repulsive force to become almost the same as the compressive force concerning the bellows used in order to connect two vacuum chambers.
[0022] The 7th means for solving said technical problem is vacuum chamber combination which comes to join two vacuum chambers together with bellows, and is vacuum chamber combination (claim 7) characterized by having arranged one load cancellation device of said 1st means to the 6th means at equal intervals on plurality and the concentric circle centering on the core of said bellows.
[0023] According to this means, it inclines and the compressive force concerning the bellows which combines two vacuum chambers can be canceled that there is nothing.
[0024] The 8th means for solving said technical problem is vacuum chamber combination which comes to join two vacuum chambers together with bellows, and is vacuum chamber combination (claim 8) characterized by having arranged the load cancellation device given in any 1 term on a straight line among claim 1 to claims 6 in the location which becomes symmetrical to plurality and said bellows.
[0025] In this means, since area for attaching a load cancellation device in a vacuum chamber can be made into the minimum, the volume of a chamber can be made into the minimum. In addition, it is desirable to suppose that it is horizontal about the direction of an above-mentioned straight line. It is because, as for the reason, a vacuum chamber generally makes the volume the minimum, so the volume of the vacuum chamber which the dimension of a lengthwise direction increases even when it becomes unnecessary to newly establish the clamp face in many cases and the clamp face newly needs to be established by supposing that it is horizontal since it is small can be made into the minimum even if area

(footprint) is large.
[0026] The 9th means for solving said technical problem is an aligner (claim 9) characterized by for one side being the vacuum chamber which constitutes an aligner among the vacuum chambers which constitute either of said 1st means to the 8th means, and being the vacuum chamber to which another side contains the transport device which supplies a wafer to the aligner concerned.
[0027] In this means, since the vibration in the vacuum chamber which contains the transport device which supplies a wafer to an aligner does not get across to the vacuum chamber which constitutes an aligner, it can do conveyance and the exposure activity of a wafer, and can consider as the good aligner of a throughput.
[0028] The 10th means for solving said technical problem is the manufacture approach (claim 10) of the semiconductor device characterized by using the aligner which is said 8th means and coming to have the process which carries out the exposure imprint of the circuit pattern formed in the mask or the reticle at a wafer.
[0029] In this means, since the good aligner of a throughput can be used, a semiconductor device can be manufactured efficiently.
[0030]
[Embodiment of the Invention] Hereafter, the example of the gestalt of operation of this invention is explained using drawing. Drawing 1 and drawing 2 are drawings showing the gestalt of operation of this invention, and use this invention for an aligner. Drawing where drawing 1 removed the superstructure of vacuum chambers, and 2 are the A-A sectional views of Fig. 1. drawing 1 and drawing 2 — setting — 1 — bellows and 2 — a pneumatic spring and 3 — a wafer stage chamber and 4 — a transport-device vacuum chamber and 5 — a wafer and 6 — a vibrationproofing base and 7 — a carrier robot and 8 — a wafer stage and 9 — a gate valve, and 10 and 11 — a vacuum pump and 12 — the bottom base and 13 — a variation rate — as for a load lock chamber and 15, the absorption section and 14 are [a vacuum pump and 16] gate valves.
[0031] First, the sequence of conveyance is explained. A gate valve 16 opens [a load lock chamber 14] in the state of an atmospheric pressure, and a wafer 5 is carried into a load lock chamber 14. Then, a gate valve 16 is closed and vacuum suction is started. If it becomes a predetermined pressure, a gate valve 9 will open and a wafer 5 will be conveyed by the carrier robot 7 on the wafer stage 8. The transport-device vacuum chamber 4 is carrying out the structure separated in the wafer stage chamber 3, and is connected with the bottom base 12.
[0032] Moreover, the two above-mentioned vacuum chambers 3 and 4 have a coil-spring-like degree of freedom, are connected with the bellows 1 with which inside serves as a cavity, and are open for free passage. Therefore, since the interior of bellows 1 is a vacuum, huge compressive force joins bellows 1. In order to remove this compressive force, it is equal, and the Z direction location of both the sides of bellows 1 has arranged two pneumatic springs 2 in parallel with bellows 1 in the location which is in the equal distance from bellows 1, and the force F produced in bellows 1 was shared one half (f) every, respectively, and it has removed by performing load cancellation.
[0033] The damping effect has a greatest property and the pneumatic spring 2 makes it the minimum to transmit the vibration at the time of actuation of a vacuum pump 10, a vacuum pump 15, a carrier robot 7, a gate valve 9, and a gate valve 16 to the wafer stage chamber 3. Moreover, bellows 1 also has the damping effect of oscillating transfer.
[0034] The vibration at the time of a wafer 5 being conveyed in the wafer stage 8 is not transmitted to the wafer stage 8 through the wafer stage chamber 3 by the above thing. Therefore, also in the time zone which is performing exposure processing of a wafer 5, since it becomes possible to convey [to / from the outside / near the wafer stage 8] the following wafer for the next processing and exposure processing and conveyance actuation can be performed in parallel, the improvement in a throughput of the whole equipment is possible. In this case, the table for standby of the following processing object may be installed in the transport-device vacuum chamber 4, and a carrier robot may be used as a double arm mold.
[0035] In addition, a pneumatic spring 2 prepares three or more pieces at equal intervals on the circle of the core of bellows 1, and this alignment, and you may make it cancel the compressive force concerning bellows 1 equally. Moreover, although it is ideal to use a pneumatic spring for absorbing vibration, other elastic members, such as a machine spring, can also be used depending on the case.

[0036] In the wafer stage chamber 3 side, while the vibrationproofing base 6 is arranged between the wafer stage chamber 3 and the bottom base 12 and having removed the vibration from a floor, the shake by actuation of the body processing section is removed. That is, vibration-deadening control is performed. However, while needing time amount for stabilizing when inertial force, center-of-gravity movement magnitude, and acceleration are large, it is accompanied by migration of the deflection of a cross direction, torsion, etc. That is, the wafer stage chamber 3 will exercise slightly.
[0037] Therefore, in the gestalt of this operation, in order to prevent transfer of vibration of the transport-device vacuum chamber 4, the displacement absorption section 13 is formed in the point of a pneumatic spring 2 as further device. The example of the structure is shown in drawing 3 . Drawing 3 shows the B section of drawing 1 in detail. In the following drawings, the same sign may be given to the same component as the component shown in the above-mentioned drawing, and the explanation may be omitted. For a shaft and 19, as for a cloth roller table and 21, in drawing 3 , spherical bearing and 20 are [17 / the link mechanism section and 18 / Y shaft-orientations cloth roller table and 22] Z shaft-orientations cloth roller tables.
[0038] Although a pneumatic pressure spring can absorb the variation rate of X shaft orientations in drawing, it cannot absorb pitching, rolling, and yawing and cannot absorb the variation rate of Y shaft orientations and Z shaft orientations. In the gestalt shown in drawing 3 , a pneumatic spring 2 is combined with a shaft 18, and the shaft 18 is combined with the link mechanism section 17 by spherical bearing 19. Therefore, pitching, rolling, and yawing are absorbable with this joint device.
[0039] The link mechanism 17 is combined with the transport-device vacuum chamber 4 through the cloth roller table 20. The cloth roller table 20 is constituted combining Y shaft-orientations cloth roller table 21 and Z shaft-orientations cloth roller table 22. Therefore, the variation rate of Y shaft orientations and Z shaft orientations is absorbable with this device.
[0040] Therefore, no variation rates of 6 shaft orientations of the transport-device vacuum chamber 4 are no longer transmitted to the wafer stage chamber 3 side by combining a pneumatic spring 2 and the transport-device vacuum chamber 4 through these devices.
[0041] Drawing 4 is drawing showing the principle of one example of the elastic body used instead of the pneumatic spring 2 shown in drawing 1 and drawing 2 , and cancels the compressive force of bellows 1 using the pressure in each vacuum chamber. For 23, as for the 1st supporter and 25, in drawing 4 , bellows and 24 are [the 2nd supporter and 26] the communicating tubes.
[0042] Bellows 23 is having the end face by the side of the wafer stage chamber 3 supported by the 2nd supporter which the end face by the side of the transport-device vacuum chamber 4 was supported, and was fixed to the transport-device vacuum chamber 4 by the 1st supporter 24 fixed to the wafer stage chamber 3. And the interior of bellows 23 is open for free passage in the wafer stage chamber 3 with the communicating tube 26. Therefore, bellows 23 receives compressive force according to the difference of the internal pressure and external pressure, therefore the 2nd supporter 25 of facing the right [supporter / 24 / 1st] receives the leftward force in drawing.
[0043] Therefore, the compressive force committed to bellows 1 is mostly cancellable by repulsive force's working between the wafer stage chamber 3 and the transport-device vacuum chamber 4, and making the gross area (number of each cross-sectional-area x bellows 24) of bellows 23 almost equal to the cross-sectional area of bellows 1. In this means, since the cancellation device of compressive force itself consists of bellows, the variation rate of pitching, rolling, yawing and Y shaft orientations, and Z shaft orientations is absorbable to some extent.
[0044] Drawing 5 is drawing showing the principle of other examples of the elastic body used instead of the pneumatic spring 2 shown in drawing 1 and drawing 2 , and cancels the compressive force of bellows 1 like the example shown in drawing 4 using the pressure in each vacuum chamber. For a cylinder body and 29, as for the 2nd bellows and 31, in drawing, the 1st supporter and 30 are [27 / the 1st bellows and 28 / a piston object and 32] the 2nd supporter.
[0045] a cylinder body 28 is combined with the transport-device vacuum chamber 4 through the 1st bellows 27 — it is both fixed to the wafer stage chamber 3 by the 1st supporter 29. Inside the cylinder body, while the piston object 31 is combined with the cylinder body 28 through the 2nd bellows 30, it is fixed to the transport-device vacuum chamber 4 through the 2nd supporter (rod) 32 (although the 2nd supporter 32 and transport-device vacuum chamber 4 seem to be separated since drawing shows the cross section, it has fixed in the location which does not appear in a cross section).

[0046] Moreover, the space surrounded with the wall of the 1st bellows 27, the 2nd bellows 28, the piston object 31, and a cylinder body 28 is open for free passage in the transport-device vacuum chamber 4. Moreover, other parts inside a cylinder body (drawing right-hand side interior of a room) are wide opened by atmospheric air.
[0047] If the cross section of A1 and the piston object 31 is set to A2 for the cross section of the 1st bellows 27 and an atmospheric pressure is set to Pa, the compressive force of only Pa-A1 will work between the transport-device vacuum chamber 4 and a cylinder body 28, and this will pull the wafer stage chamber 3 to the transport-device vacuum chamber 4 side through the 1st supporter 29. Moreover, between the transport-device vacuum chamber 4 and the piston object 31, the compressive force of only Pa-A2 works through the 2nd supporter 32, and this keeps away the wafer stage chamber 3 from the vacuum chamber 4 through a cylinder body 28. After all, the repulsive force of only Pa- (A2-A1) will work to the wafer stage chamber 3 and 4 between ********** chambers.
[0048] If the installation number of such a repulsive-force generating object is set to n, the compressive force committed to bellows 1 is mostly cancellable by making n- (A2-A1) almost equal to the cross-sectional area of bellows 1. In this means, since the cancellation device of compressive force itself consists of bellows, the variation rate of pitching, rolling, yawing and Y shaft orientations, and Z shaft orientations is absorbable to some extent.
[0049] Drawing 6 is the schematic diagram of the optical system of the charged-particle aligner which is one example of the gestalt of operation of the aligner of this invention. drawing 6 — setting — 41 — a charged-particle line source and 42 — for an aperture diaphragm and 45, as for the lens for projection, and 47, a reticle and 46 are [the lens for lighting, and 43 / hollow aperture and 44 / an aperture diaphragm and 48] wafers.
[0050] The charged-particle line emitted from the charged-particle line source 41 illuminates a reticle 45 top to homogeneity with the lens 42 for lighting. Image formation of the image of the pattern formed on the reticle 45 is carried out on a wafer 48 with the lens 46 for projection, and it exposes the resist on a wafer 48. In order to cut the scattered radiation and to restrict angular aperture, aperture diaphragms 44 and 47 are formed.
[0051] Although the detailed explanation beyond this is omitted since such a charged-particle line aligner is well-known, in the gestalt of this operation, in the lens-barrel I of an illumination system, a reticle 45 is formed in the reticle stage chamber R, and the projection lens 46 and the aperture diaphragm 47 are formed for the charged-particle line source 41, the lens 42 for lighting, the hollow aperture 43, and an aperture diaphragm 44 in the lens-barrel P of a projection system. Moreover, a wafer 48 (5) is conveyed in the wafer stage 8 in the wafer stage chamber 3 by the carrier robot 7 in the transport-device vacuum chamber 4.
[0052] In the gestalt of this operation, since the body section of the charged-particle line aligner which consists of a component shown in drawing 6 is installed in the wafer stage chamber 3 of a configuration as shown in drawing 1 , vibration of carrier-robot 7 grade is not transmitted to the body section of a charged-particle line aligner. Therefore, exposure actuation can be performed [be / it / under / wafer conveyance-/ simultaneous operation].
[0053] Hereafter, the example of the gestalt of implementation of the manufacture approach of the semiconductor device concerning this invention is explained. Drawing 7 is a flow chart which shows an example of the semiconductor device manufacture approach concerning this invention. The production process of this example includes each following primary routing.
** The wafer production process which manufactures a wafer (or wafer preparation process of preparing a wafer)
** The mask production process which manufactures the mask used for exposure (or mask preparation process of preparing a mask)
** It cuts down at a time one chip formed on the wafer processing process ** wafer which performs processing processing required for a wafer, and consists of a sub process of further some [process / each] whose chip erector who makes actuation become possible ** Is the chip inspection process which inspects the made chip.
[0054] The primary routing which has decisive effect on the engine performance of the device of a semiconductor in such primary routing is a wafer processing process. At this process, the laminating of the designed circuit pattern is carried out one by one on a wafer, and much chips which operate as memory

or MPU are formed. This wafer processing process includes each following process.
** The film formation process which forms the metal thin film which forms the dielectric thin film used as an insulating layer, the wiring section, or the polar zone (CVD, sputtering, etc. are used)
** The etching process which processes a thin film layer and a substrate according to the lithography process ** resist pattern which uses a mask (reticle) and forms the pattern of a resist in order to process alternatively a degree [acid chemically-modified] ** thin film layer, a wafer substrate, etc. which oxidize this thin film layer and wafer substrate (for example, a dry etching technique is used)
** A wafer processing process performs repeatedly only the required number of layers which is the inspection process which inspects the wafer processed into the ion and impurity impregnation diffusion process ** resist exfoliation process ** pan, and manufactures the semiconductor device which operates as a design.
[0055] Drawing 9 is a flow chart which shows the lithography process which makes the nucleus of the wafer processing process of drawing 8 . This lithography process includes each following process.
** About the semiconductor device production process beyond the annealing process for stabilizing the resist pattern which develops the resist which exposes the resist spreading process ** resist which carries out the coat of the resist on the wafer with which the circuit pattern was formed at the process of the preceding paragraph, and of which exposure process ** exposure was done, and obtains the pattern of a resist and of which development process ** development was done, a wafer processing process, and a lithography process, it is a well-known thing and explanation beyond this will not require.
[0056] If the aligner concerning this invention is used for the exposure process of ** in the above-mentioned lithography process, since exposure and carrying in of a wafer can be performed, a throughput can be raised.
[0057]
[Effect of the Invention] As explained above, in invention which relates to claim 1 among this inventions, vibration generated in one vacuum chamber can be made into the structure which is hard to transmit to the chamber of another side. In invention concerning claim 2, the damping effect of vibration can be enlarged especially and big elastic force can be taken out also with the small cross section.
[0058] In invention concerning claim 3, vibration of 6 shaft orientations is absorbable. Even when a degree of vacuum changes from claim 4 in invention concerning claim 6, the balance of the force is maintained, and it is not necessary to change the force to apply. Moreover, vibration of 6 shaft orientations is absorbable to some extent.
[0059] In invention concerning claim 7, it inclines and the compressive force concerning the bellows which combines two vacuum chambers can be canceled that there is nothing. In invention concerning claim 8, even when it becomes unnecessary to newly establish the clamp face in many cases and the clamp face newly needs to be established, the volume of the increasing vacuum chamber can be made into the minimum.
[0060] In invention concerning claim 9, conveyance and the exposure activity of a wafer can be done and it can consider as the good aligner of a throughput. In invention concerning claim 10, since the good aligner of a throughput can be used, a semiconductor device can be manufactured efficiently.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing (top view) showing the gestalt of operation of this invention.
[Drawing 2] It is drawing (sectional view) showing the gestalt of operation of this invention.
[Drawing 3] It is drawing showing the device of the displacement absorption section.
[Drawing 4] It is drawing showing the principle of one example of the elastic body used instead of a pneumatic spring.
[Drawing 5] It is drawing showing the principle of other examples of the elastic body used instead of a pneumatic spring 2.
[Drawing 6] It is the schematic diagram of the optical system of the charged-particle aligner which is one example of the gestalt of operation of this invention.
[Drawing 7] It is the flow chart which shows an example of the semiconductor device manufacture approach concerning this invention.
[Drawing 8] It is the flow chart which shows the lithography process which makes the nucleus of the wafer processing process of drawing 8 .
[Drawing 9] It is drawing showing the conventional technique used in order to connect two vacuum chambers.
[Drawing 10] It is drawing showing the conventional technique used in order to connect two vacuum chambers.
[Description of Notations]
1 [— Transport-device vacuum chamber,] — Bellows, 2 — A pneumatic spring, 3 — A wafer stage chamber, 4 5 [— Wafer stage,] — A wafer, 6 — A vibrationproofing base, 7 — A carrier robot, 8 9 [— Bottom base,] — A gate valve, 10 — A vacuum pump, 11 — A vacuum pump, 12 13 [— Gate valve,] — The displacement absorption section, 14 — A load lock chamber, 15 — A vacuum pump, 16 17 [— Cloth roller table,] — The link mechanism section, 18 — A shaft, 19 — Spherical bearing, 20 21 — Y shaft-orientations cloth roller table, 22 — Z shaft-orientations cloth roller table, 23 [— Communicating tube,] — Bellows, 24 — The 1st supporter, 25 — The 2nd supporter, 26 27 [— The 2nd bellows,] — The 1st bellows, 28 — A cylinder body, 29 — The 1st supporter, 30 31 [— The lens for lighting, 43 / — Hollow aperture, 44 / — An aperture diaphragm, 45 / — A reticle, 46 / — The lens for projection, 47 / — An aperture diaphragm, 48 / — Wafer] — A piston object, 32 — The 2nd supporter, 41 — A charged-particle line source, 42

[Translation done.]

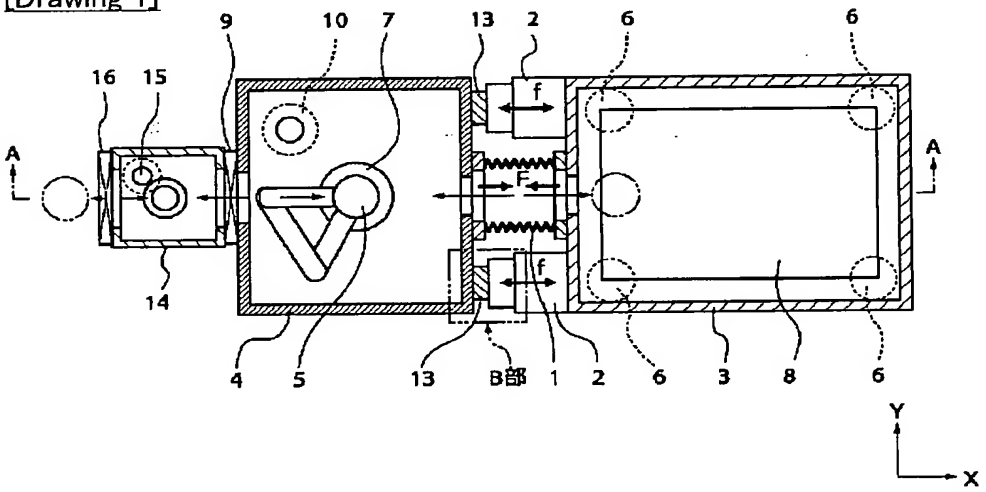
* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

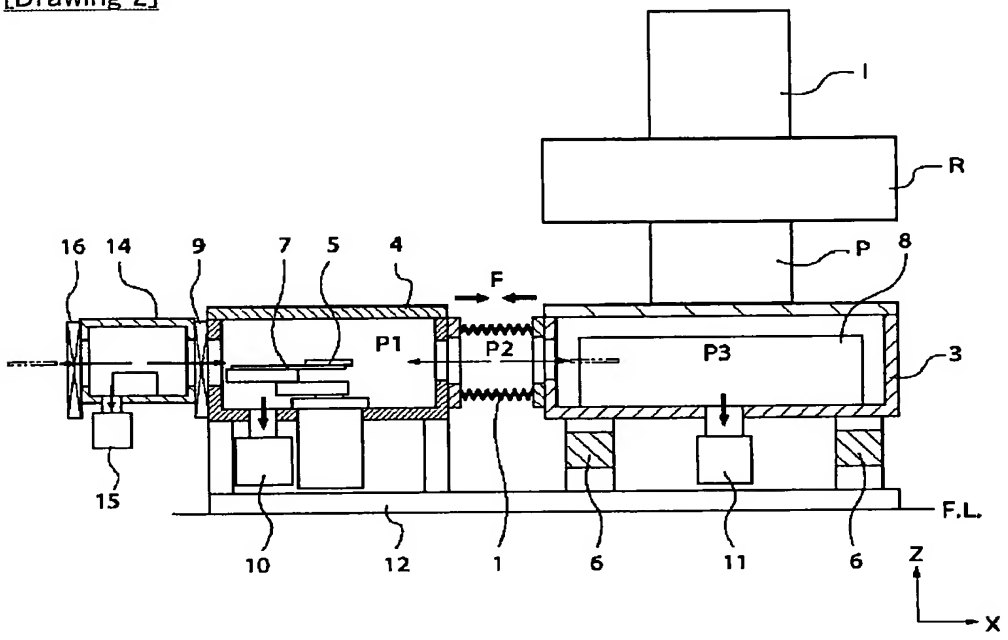
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

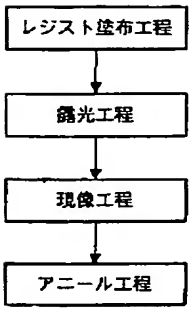
[Drawing 1]



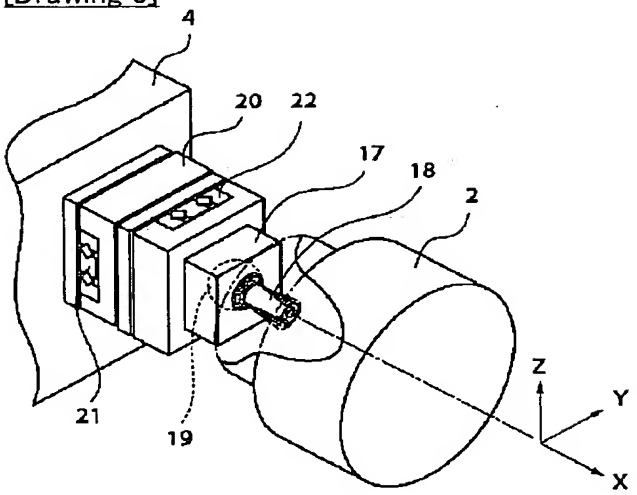
[Drawing 2]



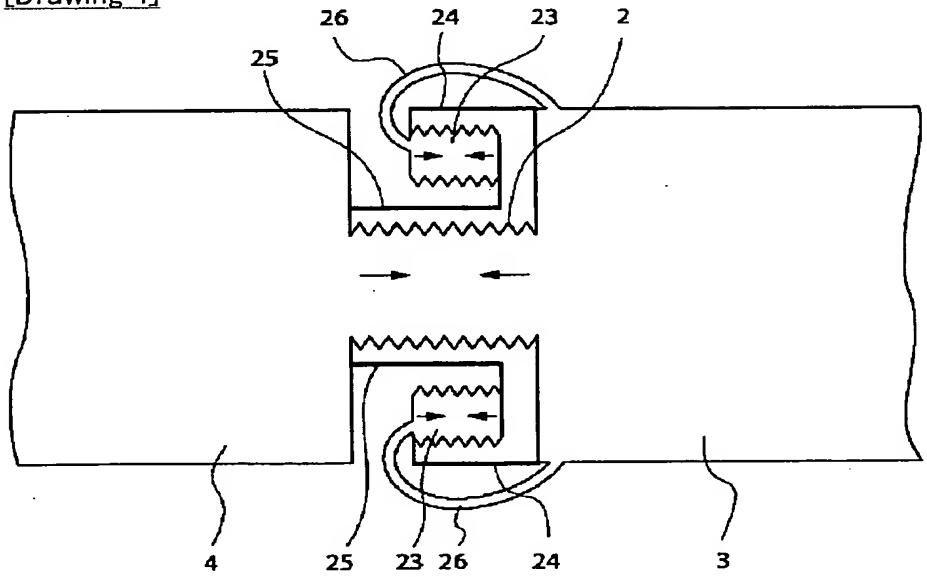
[Drawing 8]



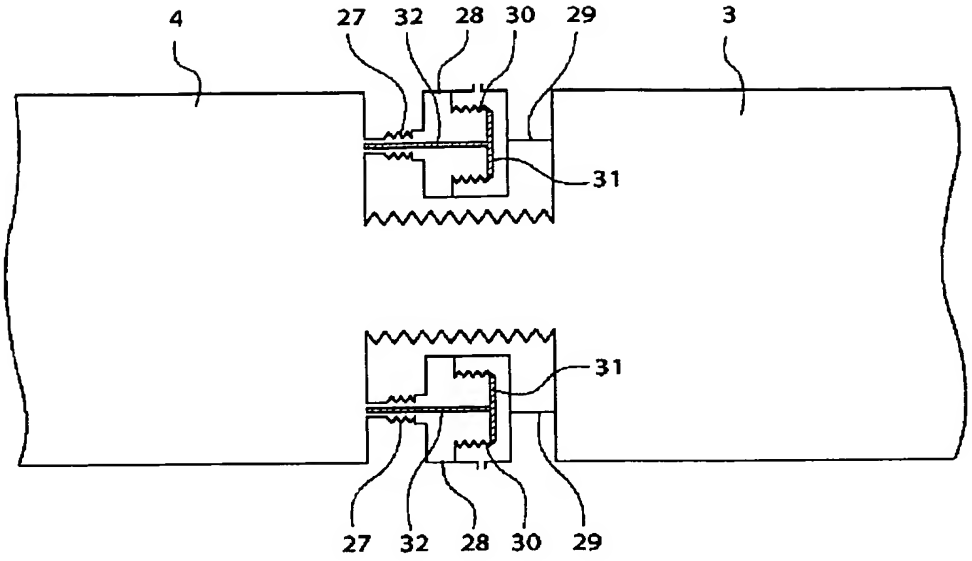
[Drawing 3]



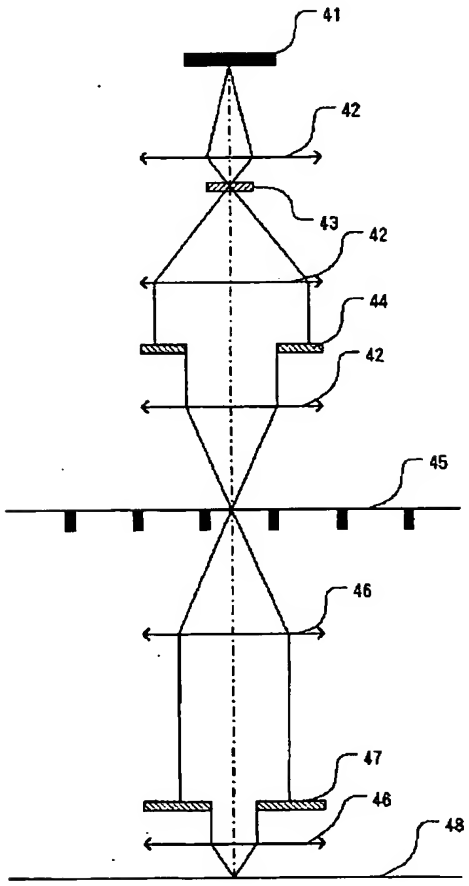
[Drawing 4]



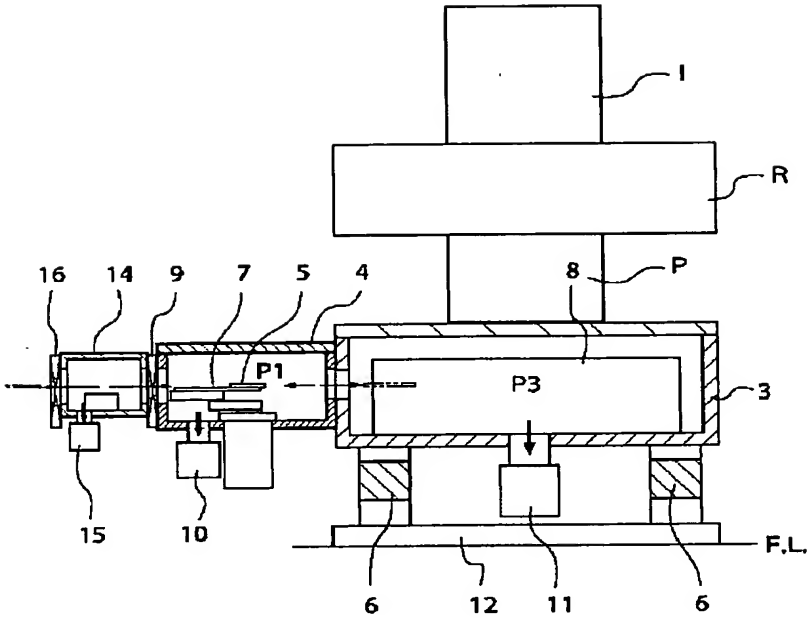
[Drawing 5]



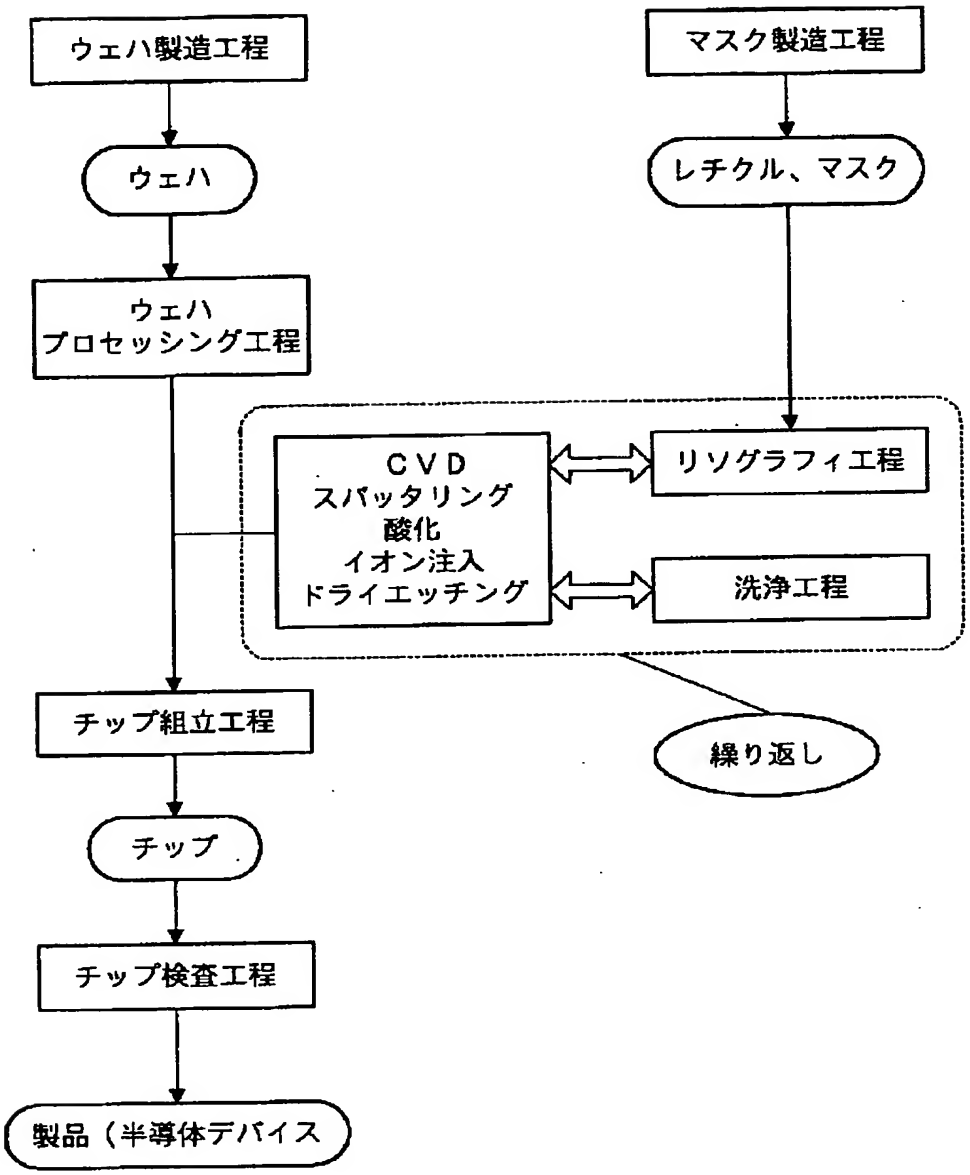
[Drawing 6]



[Drawing 9]



[Drawing 7]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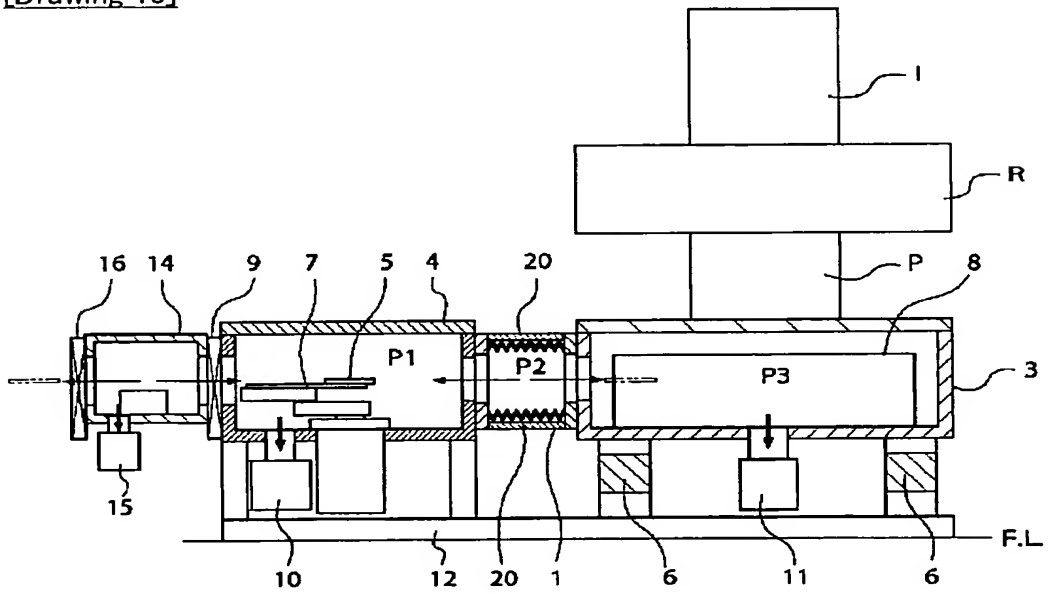
マスク製造工程
ウェハ
レチクル、マスク
ウェハ
プロセッシング工程
CVD
スパッタリング
酸化
イオン注入
ドライエッチング
リソグラフィ工程
洗浄工程
チップ組立工程
繰り返し
チップ
チップ検査工程
製品（半導体デバイス

[Drawing 10]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[Translation done.]